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ABSTRACT

Integrating computer-based communication into the delivery of a course is not a simple task, but it need not be a daunting one. With conscientious planning, coordination with institutional resources, preparation of training materials, and flexible responses to student learning, an instructor can readily succeed. Concerns and problems encountered in the implementation of computer-based communication tools (CBCT) methods, particularly electronic mail, in the classroom include unreliability of the computer system, slow system response, allocation of computer accounts, student comfort level, instructor comfort level, amount of technological detail, equal participation, delivery of pedagogical content, and student evaluation. To successfully use e-mail, or other CBCTs, as pedagogical tools, instructors should be familiar with the chosen technology, be flexible concerning assignments and course requirements, plan ahead, and open and maintain communication links with the technical support staff. Contains 17 references. A detailed checklist for CBCT implementation in the classroom is attached. (RS)

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COMPUTER-BASED COMMUNICATION AND THE CLASSROOM: THE PRACTICAL CONCERNS OF IMPLEMENTATION

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Abstract

Integrating computer-based communication into the delivery of a course is not a simple task, but it need not be a daunting one. With conscientious planning, coordination with institutional resources, preparation of training materials, and flexible responses to student learning an instructor can readily succeed. This paper presents the concerns and problems encountered in the implementation of computer-based communication methods. Lessons learned and strategies for avoiding similar problems in the future are discussed. A checklist of key steps is provided to guide future users of such communication technology.

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Abstract

Integrating computer-based communication into the delivery of a course is not a simple task, but it need not be a daunting one. With conscientious planning, coordination with institutional resources, preparation of training materials, and flexible responses to student learning an instructor can readily succeed. This paper presents the concerns and problems encountered in the implementation of computer-based communication methods. Lessons learned and strategies for avoiding similar problems in the future are discussed. A checklist of key steps is provided to guide future users of such communication technology.

1. Introduction

In the not-so-distant past, the usage of computer technology in classroom learning situations was the sole purview of educators involved with highly technical subjects that required the computational support of such technology (e.g., hard sciences such as chemistry, physics, biology or technical areas such as computer science/electrical engineering) or computer-assisted learning environments for writing and/or self-paced training exercises (Barrett, 1993; Krol, 1992; Matta & Kern, 1991; Visual Edge Productions, 1994). With the recent explosion of available and accessible computer technology on University and College campuses, computer-based communication tools (CBCTs) can be easily utilized as an instructional resource in the delivery of **any** course (for example, see Santoro, 1994; Barrett, 1993; Visual Edge Productions, 1994; Claffy, Braun, & Polyzos, 1994; Berners-Lee, Cailliau, Luotonen, Nielsen, & Secret, 1994). However, integrating the use of CBCTs into a traditional classroom course must be done carefully and with forethought in order to afford a successful educational experience for the students (Duin, 1991; Leidner & Jarvenpaa, 1993; Barrett, 1993). The purpose of this paper is to provide a practical understanding of the kinds of issues an instructor needs to be aware of when implementing CBCTs in a course. Based on our research team's experiences with the course curriculum of five departments across three universities, this paper will map out potential trouble

areas during implementation of CBCTs and suggest strategies for avoiding problems. A checklist of key steps is provided in an appendix as a guide for future users of CBCTs in the classroom.

The remainder of this paper is divided into three sections. Section 2 states the contextual background of our classroom situations, including the specific type of CBCT utilized in our teaching activities. Section 3 presents several of the more commonly encountered problems in CBCT implementation and offers suggestions for preventing these problems. Section 4 provides a summary of key points and concludes the paper. The appendix supplies a checklist of preparation steps for individuals considering the use of such technology.

2. Background and Context

The CBCT of choice in our three universities was electronic mail (e-mail). As with many situations relying upon information technology, a number of different configurations in terms of hardware and application software packages were available for use by the students in our classes. The hardware platforms for e-mail access included mainframe text terminals, microcomputers as part of a local area network (LAN) in a university lab, and off-campus microcomputers with modem connections to university computing resources. E-mail software applications included PINE, elm, Eudora, and POPMail.

Three of the five courses using CBCT as part of the delivery of the course were communication classes; the other two courses were information systems courses. E-mail was used as a means of supporting small group conferences on assigned topics, a vehicle for communication among members of the class, and a mechanism for individual students to communicate with the instructor. Instructors typically provided introductory training (e.g., hands-on training or help guides) in e-mail application usage to the students during some portion of the first two weeks of the course.

3. Common Pitfalls and Problems

As with any new endeavor, there are some "bumps in the road" as you try something new in the delivery of a course. We encountered several as we tried to use e-mail in support of course objectives and have organized them into three general categories: technological, management, and pedagogical. Each of these areas will be discussed in turn.

Technological: Technological problems are those associated with the computer resources of the university (and/or College, School, or Department) supporting the course's use of e-mail. These problems tend to greatly influence the outcomes of using e-mail in a course, yet are some of the most difficult for an instructor to address. In most cases, these problems are not under the control of the instructor and resolution of the problems require opening discussions with other units within the University/College infrastructure. An overall strategy for dealing with technological problems is to: (1) be willing to adjust your time deadlines for student deliverables; and (2) open up and maintain clear channels of communication with your area's information systems (IS) provider or technical support staff. Examples of technological concerns with e-mail implementation in a class include:

- *unreliability of the "system"*: When the computer resources required to conduct assignments over e-mail are not operating in a dependable fashion, it is difficult to get any real work accomplished with the medium (Laudon & Laudon, 1994). Local and widespread network outages that send your e-mail messages into a "never-never-land" cause confusion and frustration among students trying to complete computer assignments and/or access course information. Unexpected cessations of computer service due to poor backup and security disrupt the ability of your students to submit work in a timely fashion. Additionally, the schedule of most college students does not always coincide with the traditional 9-5 work day on Monday to Friday; when students do get around to working on their assignments, having the computer resources unavailable due to technical problems or downtime can be disastrous to the success of e-mail as a classroom delivery technique.

Classroom use of e-mail works best in a systems environment that can reliably provide 20-24 hour access per day, 7 days a week.

• *multiple access points*: On most university/college campuses today, there are a myriad of ways to connect to computing resources in general, and e-mail applications in particular (Visual Edge Productions, 1994; Krol, 1992). Lab facilities are usually scattered throughout the campus, dial-in access through phone lines and modem connections is readily available, and at times students may have direct campus network access available in dormitories. Although these multiple options afford the students with greater opportunities to utilize computing resources, this configuration of resources presents the instructor with a need to have a working knowledge of each access method in order to assist students in their work. Further, the contact point within the IS support structure for each of these access options is generally different --- requiring the instructor and/or students to make multiple phone calls or inquiries in order to resolve difficulties with access to computing resources.

• *slow system response*: Computer network traffic increases considerably as the number of individuals using computer networks continues to climb on both the local level of the college/university campus and the broader level of each state, country, or region of the world (Visual Edge Productions, 1994; Kehoe, 1992; Claffy, Braun, & Polyzos, 1994). Increased network traffic slows down the time it takes to send and receive e-mail messages, just as the large number of cars on the freeways of major U.S. cities (e.g., Los Angeles, Chicago, New York) increases congestion of the traffic and slows down the speed of any one car. To some extent, the actual response time encountered while using computer resources at your school is a function of each school's unique telecommunications infrastructure as well as the school's interaction with the computer networks external to your location. E-mail users may encounter slow response time when typing in messages,

timing-out of the computer resource connection, and/or in the receipt of messages due to heavy user loads on computer networks.

• *allocated computer accounts / forgotten passwords*: Universal access to computer accounts on college campuses is a goal of most IS functions at the institutions, but is rarely the reality. As dollar costs of resource utilization continue to climb, most educational institutions are restricting the privilege of a computer account to currently registered students. Often, at the beginning of a term, there is a mismatch between the students registered in your class and the allocated computer accounts -- in other words, you may have students in your class who for one reason or another do not have a computer account. Sometimes this can be merely a short time delay where the computer accounts for newly registered students will be created in the first week of the term, but other cases may result in time delays of 2-3 weeks while the details of getting a new account allocated for the special circumstances of your student are worked out. A closely related issue to that of computer accounts is the required password for access to the account. It is a common occurrence for new or infrequent users of computer technology to forget the password required to access the computer resources. Security procedures guiding the establishment of a new password vary by locality, but can take anywhere from 1 day to 1 week to produce a new password. Classroom usage of e-mail needs to allow for some slack in the beginning of the term for resolution of these sorts of problems.

Technological problems and concerns can be very frustrating to both the students and the instructor. Unfortunately, due to the quickly changing nature of information technology, these problems cannot be eradicated. Instructors can take preventative steps to mitigate some of the technological problems by wisely planning for the use of CBCTs in the class. Keeping communication lines open with your area's IS provider or technical support staff is critical for

influencing the amount of technological problems and developing an appropriate response to the problems. Instructors need to rely upon the IS provider or technical support staff for accurate information regarding the use of IS tools and for trouble-shooting expertise. An instructor's best strategy for technological problems and concerns is first, to prevent problems from occurring by planning wisely for CBCT implementation as part of the course delivery and second, to be willing to adjust course timelines and/or deadlines if insurmountable problems occur during the timeframe of your class (e.g., campus-wide network failure causes e-mail messages to be lost, garbled, or delayed in transmission).

Management: Management problems are those concerned with the process of actually using the e-mail technology as part of the course delivery. The instructor is generally able to resolve most management problems by adjusting his/her responses to student learning while delivering the course. The best strategy for addressing management problems is a flexible instructor response. Examples of potential management concerns with e-mail implementation include:

- *student comfort level*: Each student's comfort level with the computer and e-mail technology will vary. Some students already use e-mail as a communication medium frequently and experience no difficulties with the required use during the course. At the opposite end of the continuum are students who do not understand the basic workings of computers nor the concept of electronic messaging inherent in e-mail applications. A wise instructor will adjust early lessons such that emphasis is placed on encouraging students to use the technology rather than expecting high quality outcomes. Special help sessions or tutorials (see training issue below for more detail) may need to be held to accommodate the needs of students with less experience. Instructors must make every attempt to raise the comfort level of students using e-mail so that frustrations in use do not prompt overt

resistance to classroom assignments.

• *instructor comfort level*: A student's ability to learn from the e-mail experience depends on the instructor's confident handling of the training session(s) and questions as they arise during the use of e-mail. Instructors who are uncomfortable with the computer resources, e-mail tools, and computer technology in general present contradictory messages to the student: satisfactory use of computer technology is required by the course but the instructor is not fluent in using the technology. A successful classroom implementation of e-mail needs the competent leadership of the instructor. Instructors lacking such competence or confidence should rectify the situation.

• *training and on-going help*: The successful use of e-mail in a classroom situation requires at least one (and possibly more) focused training sessions for the students on the use of the computer technology in the lab and the e-mail application. Depending on the resources available at your educational institution, these training sessions may be available via short non-credit courses/seminars held by your IS provider or technical support staff. The instructor may be able to recommend that students attend such sessions as preparation for the in-class assignments. In preparation for these training sessions, the instructor must be sensitive to the varying levels of comfort with and existing knowledge of computer technology and e-mail within his/her group of students. An instructor should also be sure to discuss with the students about the nature of asynchronous discussion -- how a message can be sent and received at any time, but the response is contingent upon a person reading the original message and composing a prompt reply. Exercises and examples are most useful to the student when they span the kinds of tasks expected of students within the course (e.g., sending, replying, forwarding, setting up nicknames or aliases for e-mail addresses, setting up distribution lists, deleting old messages, printing out messages).

The issue of how a student can obtain on-going help while using e-mail for the course should also be addressed during the initial training session(s). For example, should all inquiries be directed back to the instructor, University help resources, or other members of the class? What self-help tools or manuals exist to assist students with e-mail questions? Another strategy to consider is to pair more experienced students with less experienced students during the initial stages of e-mail usage. In this way, students can learn from each other about how to use the technology. Short help guides are also invaluable resources to students during the initial training sessions and subsequent use periods.

Finally, assisting students with poor typing skills may also become a management issue for the instructor to address. One of our research team members encountered a situation where the student could not type his account id and password before the login system timed out. The resolution for this problem spanned technological and managerial issues: the student's account id and password had to be composed of contiguous keys on the keyboard! Instructors need to realize that successful training may encompass basic keyboard skills, foundational computer technology concepts, application software training, and problem-resolution techniques.

• *Amount of technological detail*: As students begin to learn about the uses of the e-mail application or other CBCT, there is a high need for a great deal of information so that they can effectively use the technology. Yet, there comes a point when more information about how something works may cause the student to experience information overload instead of providing useful knowledge about how to use the technology. An instructor learns how best to balance these competing forces by closely monitoring student reactions to explanations and by remaining sensitive to first-time encounters with new technology.

• *Instructor workload*: A high amount of messaging activity for all participants in the course (instructor and students) is a by-product of a successful implementation of e-mail. An instructor can expect two impacts upon his/her workload under such a situation: (1) more messages to read and reply to; and (2) more frequent communication with students. When using e-mail to support small group conferences, this translates into a large number of messages to be read by the instructor for each discussion topic. As students become more successful in using e-mail technology to support discussion, these messages can also become lengthy and complex with information. The sheer volume of work involved to read each and every message can be staggering. Instructors should be aware of the time commitment necessary to support a small group conferencing effort and plan the course workload to allow adequate time for turnaround instructor comments. It should be noted, however, that the nature of e-mail is such that it gives an instructor control over **when** to respond. Thus, while the volume of interaction will increase, the instructor has control over when to read it and when and how to respond.

• *Equal participation*: A key area of concern is whether or not all the group members are participating in the e-mail discussions with enough frequency and responsiveness to support a useful discussion of the topic. Feedback and evaluation mechanisms can be one means of notifying students how their level of participation is affecting group outcomes; direct instructor intervention (by means of personalized e-mail messages or after class discussions) may be necessary to encourage higher levels of participation.

Instructors have more direct control over managerial problems and issues than over technological problems, yet this does not make the resolution process any easier or less time-consuming. In order to keep the process of using CBCT in the classroom on an even keel,

instructors must be willing to be active participants in the use process and take action to answer student concerns and problems. Often, an instructor may be called upon to fill an intermediary helping role in the absence of institutional resources such as a help line or lab consultants. Instructors must be willing to make the dedicated time and energy commitments toward integrating the CBCT in the course.

Pedagogical: Pedagogical issues are concerned with how e-mail is used as a teaching tool/technique to assist in student achievement of course learning objectives. In some ways, these issues are more philosophical in nature and affect the instructor's motivation for using e-mail in the first place. Educators are primarily concerned with three areas in the delivery of a course: (1) transmitting content; (2) providing an arena for exchange of learning; and (3) evaluating student learning. Examples of pedagogical concerns with e-mail implementation include:

- *delivery of content*: CBCTs such as e-mail provide wonderful opportunities for instructors to make course content available to students 24-hours a day, 7-days a week. Class notes can be posted in a central location or mailed to all students prior to class sessions. Answers to questions raised in class can be distributed within hours of the class session instead of waiting for the next class meeting. Students can ask clarification questions via e-mail as they occur during preparation for the next class, thus freeing up class time for more in-depth study of the material or probing questions about key issues. E-mail can enable students to easily contact the instructor when concerns in the learning process occur, however, students must be encouraged to use e-mail in this fashion. Unfortunately, the technological problems discussed earlier may require hard copy back-ups for distribution in class. Instructors should try the technology for some time to ensure its reliability before using it as a primary distribution mechanism.

- *arena for discussion*: In all of our cases, one of the reasons for using e-mail was to

provide students with a different forum for discussion than the traditional classroom. In essence, the goal was to extend the discussion space of the classroom beyond the boundaries imposed by time and geography. One of the key aspects of this kind of use is for the students to take the discussion seriously -- to actively participate over time, not all at once at the end of the assignment period as a paper might be constructed. An instructor must stay on top of this as the term progresses and take action when students are not "discussing".

• *evaluation*: In order to learn from the experience, students require prompt and detailed feedback on their performance. Instructors must decide how and with what frequency communication with the students will be conducted. An important part of this communication is to provide the students with a clear understanding of the instructor's expectations for each assignment. As students progress in their learning in the class, it can be appropriate to change the instructor's expectations to reflect higher levels of learning (e.g., moving along Bloom's taxonomy from knowledge to evaluation) required by subsequent assignments (Bloom, 1956). As always, fairness dictates that instructors need to inform students of the change in expectations prior to the actual assignment. Instructors might consider incorporating a statement reflecting this philosophy into their syllabus.

As in a non-technology supported course, an instructor's priority is that students learn from the experiences provided in the course. E-mail can help instructors achieve this goal, and address the pedagogical issues listed above.

4. Summary and Conclusion

This paper has presented many problems that can, have, and will be encountered in using e-mail and other CBCTs as pedagogical tools. While the picture we paint may look bleak, it need

not be. The issues we raise are intended to help other instructors avoid the problems we have stumbled upon. The additional communication channel seems to provide an arena for people who prefer not speak publicly. Also, it expands the perceived availability of the instructor, while still allowing the instructor to have control over that availability. Perhaps the most important is that the CBCT extends the time available for class discussion. In many of our classes, this has resulted in very interesting and insightful issues being raised and addressed. So, you see, it's not all bad!

In order to successfully use e-mail, or other CBCTs, as a pedagogical tool, the instructor should: 1) be familiar with the chosen technology; 2) be flexible in their approach to assignments and course requirements; 3) plan ahead; and 4) open and maintain communication links with the local IS provider or technical support staff. CBCTs can be valuable as a central course delivery tool, or as an additional means of communication. In any case, we wish you the best in your endeavors using this technology.

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Appendix
Checklist for CBCT implementation in the classroom

Before the course

1. Meet with your local IS provider or technical support person to discuss: (a) access information (dial-in phone numbers, modem connections, lab hours, accounts, passwords); (b) availability of trouble-shooting and help staff for students; (c) available training sessions or instructional guides; and (d) technology sales --where students can acquire hardware and software if they desire.

2. Practice using the actual technology tools your students will use. Do the assignments so you are sure they **can** be done.

3. Develop training guides and sessions for what can not be provided by your institutional resources.

4. Incorporate flexibility into the syllabus so that technology issues can be accommodated with little disruption to course content and assignments.

During the Course

1. Ask if there are any questions on the use of e-mail in class; allow time for some in-class questions and answers.

2. Monitor student progress. Comment in class on your observations.

3. The students and the instructor should retain copies of all mail sent and received. This will minimize problems with the technology since anyone can then re-transmit a missing message. This process is advantageous as the message need not be retyped and the message will retain its original date, thus dissuading due date discrepancies.

4. Encourage students to communicate with you via e-mail. One incentive to encourage this is if you are only in your office **during** your stated office hours, but promise availability via e-mail.

5. Maintain communication with your local provider of technical support so you can be apprised of problems and react accordingly.

After the Course

1. Have students evaluate the use of this technology in the course. Items to include are (a) student perception of instructor's comfort with the technology; (b) student's level of comfort with the technology; and (c) student evaluations of how technology was used in this course.

2. Conduct a self evaluation of the use of the technology. The instructor should track what worked and what did not. Additionally, the instructor ought to track his/her own comfort level with the technology as well as the perceived student comfort level.

3. Communicate usage issues to your local IS provider so that problems can be fixed, systems can be upgraded, and needed functions can be retained. This can also be used as an opportunity to find out what is new in computing on your campus.

4. Upgrade instructor skills. Technology changes quickly and it is likely that instructors will need to brush up on the newly available features and technologies.

5. Upgrade training materials and course materials that refer to the technology. Technology labs, phone numbers, and software may change on a quarter or semester basis.